

show an excess current in the presence of dissolved oxygen. Gas flow is maintained throughout the duration of the measurement.

Suitable inert gases are nitrogen, argon and helium. If desired, these gases may be passed through an oxygen scavenging system **90** before being passed into the chamber. A suitable system is the Model 1000 oxygen trap from Chromatography Research Supplies (Addison, Ill.).

Yet another option is to divide the gas flow into two paths, taking one through a desiccant chamber **91** and the other through water **92**, and then mixing the wet and dry gasses to obtain a controlled humidity in mixer **93**. The humidified gas is then passed into the chamber **37** through inlet tube **39** resulting in a controlled humidity environment inside the chamber.

It is sometimes desirable to conduct the surface measurements under a covering liquid. For example, a layer of an insulating liquid such as toluene, mesitylene, or paraffin oil may be placed over the sample to prevent contamination from the ambient environment. However, it is important that this liquid be free of dissolved oxygen. This is easily achieved in the present invention by the placement of a liquid cell on the sample stage **32** as shown in FIGS. **6** and **7**. The liquid cell **41** comprises a ring of Teflon®, nylon, Kel-F® or other insulating material pushed down against sample **43** by a clamping plate **70** connected to sample stage **32** by screws **72**. The cell is filled with a liquid **42**, and probe **29** is lowered into the cell on the end of an optically-transparent cantilever holder **40**. The entering **22** and exiting **24** laser beams pass through the window **25**. Electrical connections **44**, **45** are made to the probe **29** and the sample **43** and are passed out of the hermetically sealed chamber as shown in FIG. **4**.

The procedure for ensuring that a liquid is degassed is as follows: The atomic force microscope tip is first used as an electrode in a liquid cell that contains the desired liquid and an inert metal surface such as gold and a reference electrode. The potential difference between the gold surface and the reference electrode is swept from some small positive potential (with respect to the gold) to some small negative potential, and the current through the probe is measured. Dissolved oxygen will generally give rise to an excess current in the negative direction (compared to the positive direction) as molecular oxygen is dissolved. When this current is observed, the flow of inert gas is started and continued until the excess current at negative bias is eliminated. This establishes the procedure that must be used when the same liquid is degassed prior to use in an imaging experiment.

While the embodiments described above are to be preferred for ease of use of the microscope, other embodiments are also useful. As illustrated in FIG. **8**, the entire microscope, consisting of the microscope body **33**, the adjustment screws **31**, the scanner **26**, the conductive probe **80**, sample stage **32**, sample **44**, laser **20** and detector **21** and electrical leads **45** and **44**, can all be placed inside a sealed chamber such as a bell jar **51**. Electrical connections may be made with sealed connectors **82** and a gas inlet **81** and outlet **82** provided through the base **50** on which the system stands.

While certain representative embodiments and details have been shown for purposes of illustrating the invention, it will be apparent to those skilled in the art that various changes in the methods and apparatus disclosed herein may be made without departing from the scope of the invention, which is defined in the appended claims.

What is claimed is:

1. A scanning probe microscope for measuring the characteristics of a surface of a sample comprising:
 - a probe for scanning the surface of said sample;
 - a sample stage adapted to position said sample in said microscope;
 - a source of voltage in communication with said probe and said sample;
 - a detector for measuring the electrical current to or from said probe and said sample; and
 - said probe and said sample being positioned in an enclosure which isolates said probe and said sample from the ambient environment, said enclosure including a gas inlet and a gas outlet for controlling the environment in said enclosure to maintain the atmosphere in said enclosure at approximately atmospheric pressure.
2. A scanning probe microscope as claimed in claim **1** in which said enclosure is sealed.
3. A scanning probe microscope as claimed in claim **1** including a source of inert gas communicating with said gas inlet.
4. A scanning probe microscope as claimed in claim **1** including a trap for removing molecular oxygen from gas entering said gas inlet.
5. A scanning probe microscope as claimed in claim **1** including a humidity controller communicating with said gas inlet.
6. A scanning probe microscope as claimed in claim **5** in which said humidity controller comprises a source of dry gas, a source of gas saturated with water vapor, and a mixer for the gases.
7. A scanning probe microscope as claimed in claim **1** further including a cell for containing a liquid positioned within said enclosure, said probe and said sample being positioned in said cell.
8. A method of operating a conducting scanning probe microscope comprising the steps of:
 - providing a sample and a probe sensitive to characteristics of the surface of said sample;
 - applying a voltage to said probe and said sample; and
 - detecting the electrical current to or from said probe or said sample; the detecting step being carried out at substantially atmospheric pressure after molecular oxygen has been displaced from the surface of said sample.
9. A method as claimed in claim **8** in which said sample and said probe are positioned in an enclosure.
10. A method as claimed in claim **9** in which said enclosure is sealed.
11. A method as claimed in claim **10** in which said enclosure includes a gas inlet and a gas outlet.
12. A method as claimed in claim **11** in which an inert gas is circulated through said enclosure through said gas inlet and said gas outlet.
13. A method as claimed in claim **11** in which gas circulated through said enclosure has been treated to remove molecular oxygen.
14. A method as claimed in claim **12** in which the humidity of the gas is controlled.
15. A method as claimed in claim **13** in which the humidity of the gas is controlled.
16. A method as claimed in claim **8** including the step of covering the surface of said sample with a liquid.
17. A method as claimed in claim **16** in which said sample and said probe are immersed in a liquid containing cell.